Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 3 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

Amendments to the Claims

The following Listing of Claims replaces all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (currently amended): A method of processing a contone image, the method comprising:

using a halftone screen to generatedetermining a bi-level bitmap of bits from a graylevel value, wherein each of the bits has a respective one of either a first value or a second value;

partitioning the contone image into an array of contone image blocks;

halftoning the image blocks;

using the bi-level bitmap to select some of the halftone image blocksgenerating a sequence of graphical code word symbols encoding information; and

modifying the selectedproducing blocks of an output halftone image blocks using code words, such that information contained in the code words is embedded in a halftone imagefrom ones of the contone image blocks and ones of the graphical code word symbols in accordance with the values of respective ones of the bits of the bi-level bitmap, wherein ones of the output halftone image blocks associated with respective ones of the bits having the first value are derived from respective ones of the contone image blocks and ones of the output halftone image blocks associated with respective ones of the bits having the second value are derived from respective ones of the graphical code word symbols.

Claim 2 (currently amended): The method of claim 1, wherein the information is embedded at a coding rate that is linked to a graylevel of a contone patch, and whereindetermining comprises determining the bitmap is produced by halftoning the constant patch ofbased on the graylevel value.

Claim 3 (currently amended): The method of claim 2, wherein the determining comprises producing the bitmap by halftoning a contone patch of the graylevel is determined by the coding ratevalue.

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 4 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

Claim 4 (currently amended): The method of claim 1, wherein the <u>determining</u> <u>comprises selecting the</u> bitmap is selected from a <u>set</u>predetermined table of bi-level bitmaps.

Claim 5 (currently amended): The method of claim 1, wherein <u>the producing</u> <u>comprises producing the output halftone image blocks with a dimension that is different from</u> <u>a corresponding dimension of the respective ones of the contone</u>unselected image blocks are of one dimension and the modified image blocks are of a different dimension.

Claim 6 (currently amended): The method of claim 1, wherein <u>the sequence of</u> <u>graphical code word symbols corresponds to</u> a graphical bar code is embedded in the halftone image.

Claim 7 (currently amended): The method of claim 1, wherein the <u>producing</u> <u>comprises</u>
   <u>halftoning the contone image blocks, and</u>
   <u>determining whether to derive ones of the output halftone image blocks from either</u> <u>respective ones of the contone image blocks or respective ones of the graphical code word</u> <u>symbols based on image intensity levels in the respective ones of the contone image</u> <u>blocks</u>use of the bi-level bit map to select an image block is bypassed if the image block meets at least one requirement.

Claim 8 (currently amended): The method of claim 1<u>7</u>, wherein the halftoning <u>comprises</u>is error diffusion halftoning<u> the contone image blocks</u>.

Claim 9 (currently amended): The method of claim 1, wherein<u>further comprising</u> <u>diffusing error values determined from the output halftone image block</u>serror caused by modifying the selected blocks is diffused.

Claim 10 (original): Apparatus for performing the method of claim 1.

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 5 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

Claim 11 (original): An article comprising memory encoded with a program for causing a processor to perform the method of claim 1.

Claim 12 (original): A method of extracting information embedded in a halftone image, the method comprising:

accessing a bi-level bit map;

partitioning the halftone image into a plurality of image blocks;

using the bitmap to select at least some of the blocks;

identifying a code word sequence in the selected blocks; and

extracting the information from the code word sequence.

Claim 13 (currently amended): The method of claim 12, wherein the ~~information is extracted~~using comprises selecting ones of the image blocks at a rate that is linked to a graylevel of the halftone image.

Claim 14 (currently amended): The method of claim 12, wherein the accessing comprises selecting the bitmap ~~is accessed~~ from a table of different bi-level bitmaps.

Claim 15 (currently amended): The method of claim ~~12~~14, wherein the accessing ~~the bitmap includes~~comprises using a gray level ~~parameter~~value as an index into the table of the different bi-level bitmaps.

Claim 16 (currently amended): The method of claim 12, wherein ~~an~~the using comprises determining which of the image blocks to select based on image intensity levels of the image blocks ~~meeting certain requirements is automatically discarded prior to the selection~~.

Claim 17 (currently amended): The method of claim 12, further comprising using unselected ones of the image blocks to ~~reconstruct~~ construct a version of the halftone image free of the embedded information.

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 6 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

Claim 18 (currently amended): The method of claim 12, wherein the extracting the
information includescomprises using probabilistic analysis to produce a set of probability
parameters, using the set of probability parameters to select the mosta likely sequence of
graphical code word symbolsimage blocks corresponding to the information image block
sequence originally encoded into the halftone image, and converting the most likely selected
sequence of graphical code word symbolsimage blocks into the extracted information.

Claim 19 (original): Apparatus for performing the method of claim 12.

Claim 20 (original): An article comprising memory encoded with a data for causing a
processor to perform the method of claim 12.

Claim 21 (currently amended): Apparatus comprising one of an encoder for encoding
a contone image and a decoder for decoding a halftone image;

the encoder using a halftone screen to generate a halftone bitmap, partitioning the
contone image into an array of image blocks, halftoning the image blocks, using the halftone
bitmap to select at least some of the image blocks, and modifying the selected halftone image
blocks using code words, such that information contained in the code words is embedded in
the halftone imagebeing operable to perform operations comprising

determining a first bi-level bitmap of bits from a graylevel value, wherein each

of the bits has a respective one of either a first value or a second value,

partitioning the contone image into an array of contone image blocks,

generating a first sequence of graphical code word symbols encoding

information, and

producing blocks of an output halftone image from ones of the contone image

blocks and ones of the graphical code word symbols in accordance

with the values of respective ones of the bits of the bi-level bitmap,

wherein ones of the output halftone image blocks associated with

respective ones of the bits having the first value are derived from

respective ones of the contone image blocks and ones of the output

halftone image blocks associated with respective ones of the bits

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 7 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

having the second value are derived from respective ones of the

graphical code word symbols; and

the decoder being operable to perform operations comprising

~~accessing~~ determining a second bi-level bit map of bits from a graylevel value,

wherein each of the bits of the second bi-level bit map has a respective

one of two different values;

partitioning a version of the output halftone image into a plurality of ~~second~~

partitioned halftone image blocks;

~~using~~ selecting ones of the partitioned halftone image blocks in accordance

with the values of respective ones of the bits of the second bitmap ~~to~~

~~select at least some of the second blocks;~~

identifying a second sequence of graphical code word ~~sequence~~ symbols ~~in~~

from the selected ones of the partitioned halftone image ~~second~~

blocks; and

extracting ~~the~~ information from the second sequence of graphical code word

~~sequence~~ symbols.

Claim 22 (currently amended): The apparatus of claim 21, wherein the ~~apparatus~~

~~includes an~~ encoder determines the fist bi-level bitmap based on ~~for embedding the~~

~~information at a rate that is linked to a graylevel of a contone patch, and wherein the halftone~~

~~bitmap is produced by halftoning the constant patch of~~ the graylevel value characterizing the

first bi-level bitmap.

Claim 23 (currently amended): The apparatus of claim 22, wherein the encoder

produces the bitmap by halftoning a contone patch of the graylevel value characterizing the

first bi-level bitmap ~~graylevel is determined by a coding rate~~.

Claim 24 (currently amended): The apparatus claim 21, wherein the ~~apparatus~~

~~includes an~~ encoder produces the output halftone image blocks with a dimension that is

different from a corresponding dimension of the respective ones of the contone image blocks~~,~~

~~and wherein unselected image blocks are of one dimension and the modified image blocks~~

~~are of a different dimension.~~

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 8 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

Claim 25 (currently amended): The apparatus of claim 21, wherein the ~~apparatus includes an encoder that embeds~~first sequence of graphical code word symbols ~~in the halftone image~~corresponds to a graphical bar code.

Claim 26 (currently amended): The apparatus of claim 21, wherein ~~the use of both bit maps is bypassed if the image block meets at least one requirement~~in producing blocks of an output halftone image the encoder performs operations comprising

halftoning the contone image blocks, and

determining whether to derive ones of the output halftone image blocks from either respective ones of the contone image blocks or respective ones of the graphical code word symbols based on image intensity levels in the respective ones of the contone image blocks.

Claim 27 (currently amended): The apparatus of claim 21, wherein the ~~apparatus includes a~~decoder ~~that extracts the information~~selects ones of the partitioned halftone image blocks at a rate that is linked to a graylevel of the version of the output halftone image.

Claim 28 (currently amended): The apparatus of claim ~~17~~27, wherein ~~the apparatus includes a decoder; and wherein~~in extracting the information the decoder uses~~includes using~~ probabilistic analysis to produce a set of probability parameters, ~~using~~uses the set of probability parameters to select ~~the most~~a likely sequence of ~~image blocks~~graphical code word symbols ~~corresponding to the information image block sequence originally~~ encoded into the output halftone image, and converting the ~~most likely~~selected sequence of ~~image blocks~~graphical code word symbols into the extracted information.

Claim 29 (currently amended): A computer-readable medium storing computer-readable instructions for causing a computer to perform operations comprising~~An article for causing a processor to encode a contone image, the article comprising memory encoded with data for causing the processor to use a halftone screen to generate a bi-level bitmap; partition the contone image into an array of image blocks; halftone the image blocks; use the bi-level bitmap to select some of the halftone image blocks; and modify the selected halftone image~~

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 9 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

~~blocks using code words, such that information contained in the code words is embedded in a halftone image~~:

determining a bi-level bitmap of bits from a graylevel value, wherein each of the bits has a respective one of either a first value or a second value;

partitioning the contone image into an array of contone image blocks;

generating a sequence of graphical code word symbols encoding information; and

producing blocks of an output halftone image from ones of the contone image blocks and ones of the graphical code word symbols in accordance with the values of respective ones of the bits of the bi-level bitmap, wherein ones of the output halftone image blocks associated with respective ones of the bits having the first value are derived from respective ones of the contone image blocks and ones of the output halftone image blocks associated with respective ones of the bits having the second value are derived from respective ones of the graphical code word symbols.

Claim 30 (currently amended): The computer-readable medium ~~article~~ of claim 29, wherein the computer-readable instructions cause the computer to perform operations comprising determining the bitmap based on the graylevel value~~the information is embedded at a rate that is linked to a graylevel of a contone patch, and wherein the bi-level bitmap is produced by halftoning the constant patch of the graylevel~~.

Claim 31 (currently amended): The computer-readable medium ~~article~~ of claim 30, wherein the computer-readable instructions cause the computer to perform operations comprising producing the bitmap by halftoning a contone patch of the graylevel value ~~graylevel is determined by a coding rate~~.

Claim 32 (currently amended): The computer-readable medium ~~article~~ of claim 29, wherein the computer-readable instructions cause the computer to perform operations comprising producing the output halftone image blocks with a dimension that is different from a corresponding dimension of the respective ones of the contone image blocks ~~unselected image blocks are of one dimension and the modified image blocks are of a different dimension~~.

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 10 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

Claim 33 (currently amended): The computer-readable medium article of claim 29, wherein the sequence of graphical code word symbols corresponds to a graphical bar code~~are added to the halftone image~~.

Claim 34 (currently amended): The computer-readable medium ~~article~~ of claim 29, wherein the~~ use of the halftone screen to select an image block is bypassed if the image block meets at least one requirement~~ computer-readable instructions cause the computer to perform operations comprising

halftoning the contone image blocks, and

determining whether to derive ones of the output halftone image blocks from either respective ones of the contone image blocks or respective ones of the graphical code word symbols based on image intensity levels in the respective ones of the contone image blocks.

Claim 35 (currently amended): A computer-readable medium storing computer-readable instructions for causing a computer to perform operations comprising:~~An article for causing a processor to extract information from a halftone image, the article comprising memory encoded with data for causing the processor to~~

~~access~~ determining a bi-level bit map of bits from a graylevel value, wherein each of the bits has a respective one of two different values;

partitioning a~~ the~~ halftone image into a plurality of partitioned halftone image blocks;

selecting ones of the partitioned halftone image blocks in accordance with the values of respective ones of the bits of ~~use~~ the bitmap~~ to select at least some of the blocks~~;

identifying a sequence of graphical code word symbols from the selected ones of the partitioned halftone image~~code word sequence in the selected~~ blocks; and

extracting~~ the~~ information from the sequence of graphical code word ~~sequence~~symbols.

Claim 36 (currently amended): The computer-readable medium ~~article~~ of claim 35, wherein the computer-readable instructions cause the computer to perform operations comprising determining the bitmap based on the graylevel value characterizing the bi-level bitmap~~information is extracted at a rate that is linked to a graylevel of the halftone image~~.

Applicant : Niranjan Damera-Venkata
Serial No. : 10/698,899
Filed : Oct. 31, 2003
Page : 11 of 21

Attorney's Docket No.: 200207907-1
Amendment dated Aug. 17, 2007
Reply to Office action dated May 17, 2007

Claim 37 (currently amended): The computer-readable medium ~~article~~ of claim 35, wherein ~~an image block meeting certain requirements is automatically discarded prior to the selection~~the computer-readable instructions cause the computer to perform operations comprising determining which of the image blocks to select based on image intensity levels of the image blocks.

Claim 38 (currently amended): The computer-readable medium ~~article~~ of claim 35, wherein the computer-readable instructions cause the computer to perform operations comprising ~~extracting the information from the code word sequence includes~~ using probabilistic analysis to produce a set of probability parameters, using the set of probability parameters to select ~~the most~~a likely sequence of ~~image blocks~~graphical code word symbols ~~corresponding to the information image block sequence originally~~ encoded into the halftone image, and converting the ~~most likely~~selected sequence of ~~image blocks~~graphical code word symbols into the extracted information.